

# 1 Introduction

The Wachusett Watershed Protection Plan, as conceived and implemented, has been effective in maintaining the integrity of the watershed as a barrier against contamination of the Wachusett Reservoir.

U.S. District Judge Richard G. Stearns, May 5, 2000

The Department of Conservation and Recreation, Division of Water Supply Protection, Bureau of Watershed Management (formerly the Metropolitan District Commission Division of Watershed Management) and the Massachusetts Water Resources Authority (MWRA), partners in delivering drinking water to over half of Massachusetts's citizens, are entering into a new era of facilities and management. The Bureau of Watershed Management has successfully reached watershed management milestones in water quality, monitoring, land acquisition, and sewer improvements. The MWRA is completing a ten-year, \$1.7 billion Integrated Water Supply Improvement Program. Together, these agencies enter the new millennium poised to continue providing safe drinking water for the next generation.

## *1.1 2003 Reorganization of State Agencies*

A major reorganization occurred within the Executive Office of Environmental Affairs during the preparation of this plan. Chapter 26 of the Acts of 2003, § 290 created the new Department of Conservation and Recreation (DCR) by merging the Metropolitan District Commission (MDC) and the Department of Environmental Management (DEM). The DCR contains three Divisions: the Division of Urban Parks and Recreation (DUPR), the Division of State Parks and Recreation (DSPR), and the Division of Water Supply Protection (DWSP). The responsibilities of the former MDC Division of Watershed Management (MDC/DWM) have been transferred in their entirety to the Bureau of Watershed Management (BWM or "Bureau") within the Division of Water Supply Protection.

While the agency adjusts to changes to internal structures and nomenclature, the mission of the Bureau remains unaffected. The DCR/DWSP Bureau of Watershed Management, like the former MDC Division of Watershed Management, is legislatively mandated to manage and protect the drinking water supply watersheds, providing pure drinking water for distribution by the MWRA to approximately 2.2 million residents of Massachusetts.

Appropriate changes in terminology have been made throughout this document. In most cases the phrase "the Bureau" or the acronym BWM is used to reference both the current and former watershed management agency within the Department of Conservation and Recreation. In some contexts, particularly in historical discussions or referencing studies and publications, the terms "Metropolitan District Commission/Division of Watershed Management," MDC and MDC/DWM

remain accurate. In the context of this plan, “the Division” always refers to the Division of Water Supply Protection’s Bureau of Watershed Management or the former Division of Watershed Management, not to any other Division in the Commonwealth. The terms “Division lands” and “Bureau lands” refer to properties that are owned by the Commonwealth of Massachusetts and are under the care and control of the Division of Water Supply Protection, Bureau of Watershed Management.

## **1.2 Background**

The *2003 Watershed Protection Plan Update for the Wachusett Reservoir Watershed* further advances, rather than replaces, MDC/DWM’s 1998 *Watershed Protection Plan Update for Wachusett Reservoir Watershed*. The MDC/DWM’s *Watershed Protection Plan Update for Quabbin Reservoir and Ware River Watersheds* prepared in 2000 remains in effect. Even though this plan is for the Wachusett Reservoir Watershed, specific information is given for all three BWM watersheds – Quabbin Reservoir, Ware River, and Wachusett Reservoir – based on their interdependence as a water supply system.

### **1.2.1 Metropolitan Boston Water System Sources**

The Department of Conservation and Recreation, Division of Water Supply Protection, Bureau of Watershed Management and the MWRA supply drinking water to 40 communities in the metropolitan Boston area. The Town of Clinton also draws water from Wachusett Reservoir, independent of the MWRA transmission and treatment system. Two communities near Wachusett Reservoir, Worcester and Leominster, may also withdraw water from the system for emergency supply. In addition, three communities west of Quabbin Reservoir obtain their water directly from this reservoir through the Chicopee Valley Aqueduct. MWRA is responsible for treatment and transmission, while BWM is responsible for collection and safe storage of water, protection of reservoir water quality, and management of the watersheds.

**Figure 1-1** presents a system schematic. Quabbin Reservoir, the Ware River, and Wachusett Reservoir are the active water supply sources for the metropolitan Boston water system. Ware River water is transferred seasonally to Quabbin Reservoir, while Quabbin Reservoir water is transferred regularly to Wachusett Reservoir through the Quabbin Aqueduct. Wachusett Reservoir is the terminal supply reservoir. Water is withdrawn through the Cosgrove intake at the eastern end of Wachusett Reservoir, and is carried by the Cosgrove Tunnel to the distribution system. The Wachusett Aqueduct provides redundancy to the Cosgrove Tunnel; it was used during the winter of 2003-2004 to allow connections to be made to MWRA’s new Walnut Hill Treatment Plant.

The Sudbury and Foss (Framingham #3) Reservoirs are the emergency reserve water supplies for this system. There are three emergency conditions that would require the use of the Sudbury System: 1.) Wachusett Reservoir is declared non-potable; 2.) there is an inability to convey water from the Wachusett Reservoir to the MWRA system (e.g., failure of the Hultman Aqueduct, Southborough Tunnel, or the City Tunnel); or 3.) a serious drought occurs.

**Figure 1-1: General Plan of the DCR DWSP/MWRA Water Supply System**

Go to: [www.mass.gov/dcr/waterSupply/watershed/documents/2003WachWPPfig1\\_1.pdf](http://www.mass.gov/dcr/waterSupply/watershed/documents/2003WachWPPfig1_1.pdf)

Depending on the situation, the Sudbury Reservoir would be used either as a primary source of water supply, as a pass through of Wachusett Reservoir water, or as a supplemental source to the Quabbin and Wachusett Reservoirs.

The past decade's withdrawals from each source water supply are summarized in **Table 1-1**; see **Section 2.3** for water quality data and **Section 5.1** for information on water quality monitoring.

**Table 1-1:  
BWM Watershed Areas and Withdrawals from System Sources, 1990 - 2000**

Source	Watershed Area <sup>1</sup>		Net Average Annual Withdrawal (mgd)	Average Annual Withdrawal <sup>2</sup> (mgd)
	square miles	acres		
Ware River (MWRA Intake)	96	61,740	110	8.08 <sup>2</sup>
Quabbin Reservoir	187	119,940	195.2	137.9
Wachusett Reservoir	117	74,890	127.4	123.1
Total DCR/MWRA Water Supply System	401	256,570	432.6	261

Source: Watershed Statistics – DCR/DWSP/BWM GIS; Water Withdrawal Statistics: MWRA, 2003

<sup>1</sup> Including area of reservoir surface for Quabbin Reservoir and Wachusett Reservoir.

<sup>2</sup> This is not a supply but a transfer to Quabbin Reservoir

### 1.2.1 Safe Yield Estimation Model – DCR/MWRA Water Supply System

Over the years, models and plans have been developed and refined to evaluate the MWRA system capacity. A Safe Yield Model was developed in the early 1980s that simulated inflow and outflow of water into the reservoirs using data for fifty years. It concluded that the safe yield was 300 million gallons a day.

Safe Yield alone, however, does not capture all the features of the system that are of concern to watershed protection, MWRA, and the ratepayers. Consequently, MWRA collaborated with the U.S. Army Corps of Engineers and other study participants (e.g., the Water Supply Citizens Advisory Committee (WSCAC)) in the *National Study of Water Management During Drought* in order to develop a new computer model that incorporated an expanded set of performance measures. The newer reservoir model is the one used by the MWRA to simulate the effects of various operating scenarios and demand levels on reservoir performance measures.

Drought Action, as defined in MWRA's Drought Management Plan, emerges as one of the most important performance measures to consider. It is triggered before other performance measures and is the most tangible to MWRA customers. Various stages of system operation are tied to trigger ranges based on the current level of Quabbin Reservoir. The stages of drought emergency are used

to target water use reductions. At normal operation and 80% full, there are no target water use reductions. Stage 1, 2, or 3 Drought Emergency would initiate, respectively, 10%, 15%, or 30% mandatory target water use restrictions. The modeling shows that during a severe drought, like the one that occurred in the 1960s, there would be an increasing number of months of Stage 1 Drought Emergency as demand increases from 240 mgd upwards.

### **1.2.2 Contributing Watersheds**

The three contributing watersheds to Wachusett Reservoir water – Quabbin Reservoir, Ware River, and Wachusett Reservoir – total 256,570 acres, or approximately 400 mi<sup>2</sup>. Each watershed is predominantly forest, with some developed rural land uses. BWM owns about 42% of the total watershed area, and other agencies, municipalities and private agencies protect another 21% of the watershed area.

#### **Quabbin Reservoir Watershed**

The Quabbin Reservoir watershed consists of 119,940 acres, including the reservoir surface that is approximately 25,000 acres (when full) at elevation 530'. A significant portion of the Quabbin Reservoir's annual inflow is from direct precipitation that contributes about 30% annual inflow. Direct inflow from the watershed's tributaries provide 61% of the annual inflow; 17% of the total annual inflow comes from largest tributary, the East Branch of the Swift River. Other Quabbin Reservoir watershed tributaries include: the West and Middle branches of the Swift River, and Hop, Fever, and Dickey Brooks. Quabbin Reservoir also receives about 9% of its annual yield from transfers of water from the Ware River at the MWRA intake.

Ware River water transfers enter Quabbin Reservoir above the area of the intake and, due to a baffle dam, these transfers travel several miles and mix with Reservoir water before reaching the Quabbin Aqueduct intake. This process provides significant travel time (on the order of several years) allowing sunlight and biological processes to naturally treat the water, settling suspended solids and reducing color in Ware River inflows prior to reaching the intakes.

About 93.3% of the aggregated land use/land cover in the Quabbin Reservoir watershed and Ware River watershed land cover is undeveloped forests, wetlands and open water. The remaining 6.7% of the aggregated land cover/land is developed including uses such as agriculture (3.6%), residential (2.1%), other developed (0.8%), and relatively few commercial uses (0.2%), most in the distant, upper portions of the watershed. Twelve municipalities are wholly or partially located in the watershed: Athol, Barre, Belchertown, Hardwick, New Salem, Orange, Pelham, Petersham, Phillipston, Shutesbury, Ware, and Wendell.

#### **Ware River Watershed**

The Ware River watershed totals 61,740 acres. Ware River transfers are authorized between October 15 through June 15, and only river flows exceeding 85 mgd can be transferred. The transfers to Quabbin Reservoir are also limited to times when the Quabbin Aqueduct is not being used to transfer Quabbin water to Wachusett Reservoir. Ware River water is transferred to Quabbin

Reservoir based on operating rules that consider reservoir levels, seasonal hydrologic conditions and water quality. Since 1992, DCR/MWRA operating policy has been to divert Ware River to Quabbin Reservoir only, although Ware River water can be transferred to Wachusett Reservoir using the Quabbin Aqueduct.

### **Wachusett Reservoir Watershed**

The Wachusett Reservoir watershed is about 74,890 acres in area, including the 4,122 acre reservoir, and features an extensive network of streams and rivers feeding the reservoir. Quabbin transfers are the largest source of inflow to Wachusett on an annual basis (about 50%). The largest tributaries, Stillwater and Quinapoxet Rivers, together contribute another 30% of annual inflow and drain 75% of the watershed area. Both rivers, as well as Quabbin transfers, flow into Thomas Basin at the western end of the reservoir. Due to the constricted outflow from the basin into the main body of the reservoir, Thomas Basin acts as a sedimentation basin for almost 90% of Wachusett Reservoir inflows. This important feature contributes significantly to the reservoir's excellent water quality.

About 75% of the watershed is currently undeveloped forests and wetlands, including 52% BWM-owned or conservation land. The remaining 25% of the watershed includes 8% agriculture use, 9% residential use, less than 1% commercial office or industrial uses and 7% in other uses, including: transportation facilities (several highways and a railroad), and recreation. Most of the watershed lies in five municipalities: Boylston, West Boylston, Holden, Sterling, and Princeton. Parts of the watershed also extend into seven other municipalities: Clinton, Worcester, Paxton, Rutland, Hubbardston, Westminster, and Leominster.

## ***1.3 Purpose***

### **1.3.1 Previous Plans**

MDC and MWRA developed two watershed protection plans (referred to as WPPs or Plans) in 1991: one plan for activities in the Wachusett Reservoir watershed and another plan for activities in the Quabbin Reservoir and Ware River watersheds. These were the first formal written plans to address the comprehensive protection of the water supply watershed system.

The Quabbin Reservoir/Ware River Plan was submitted to Massachusetts Department of Environmental Protection (DEP) in conjunction with a request for a waiver from filtration for the Chicopee Valley Aqueduct system in 1991. MDC's implementation of the Plan began in 1991. DEP approved the Plan in January 1992.

The Wachusett Reservoir Watershed Protection Plan was not immediately submitted to DEP for approval since a filtration waiver was not initially requested for that source in 1991. MDC, however, did begin implementation of the Wachusett Plan in January 1992. Following the dramatic success of initial protection efforts, MWRA, MDC, and DEP, in June 1993, entered into a consent order establishing a "dual track" approach to determine treatment requirements of the metropolitan Boston system. Thus, it was not until September 1993 that the Wachusett Plan was submitted to DEP for formal approval, along with the addendum "Updated Information to Accompany the

Submittal of the Watershed Protection Plan, Wachusett Reservoir Watershed.” The addendum included a schedule proposing activities to implement the Plan through 1998.

In a letter dated May 24, 1994, DEP found the Wachusett Reservoir Plan to be in accordance with DEP Policy 89-09 and DEP’s guidance document, and commented that the Plan was comprehensive. DEP also approved the Implementation Schedule with one modification concerning the state’s Title 5 regulations, which were being revised at the time. DEP’s letter also includes an attachment, essentially calling for prevention of waterborne disease as the top priority.

MDC/DWM submitted the first full update of the Wachusett Reservoir Watershed Protection Plan in December, 1998; the Quabbin Reservoir/Ware River Watershed Protection Plan Update was published in December, 2000. Thus, both the Wachusett Reservoir Watershed and Quabbin Reservoir Watershed/Ware River Watershed Protection Plans and their respective updates have been approved by DEP, forming the basis for BWM’s programs since 1991.

### **1.3.2 Need for Plan Update**

Since the original Plans were prepared in 1991, BWM has greatly expanded its watershed protection programs. The 1998 *Watershed Protection Plan Update for the Metropolitan Boston Water System Wachusett Reservoir* (the 1998 Plan) established a new set of objectives for BWM to attain. Some of the Bureau’s significant achievements over the past five years include:

- Utilizing a leading-edge land acquisition model and purchasing thousands of acres of watershed lands.
- Maintaining a successful wildlife control program.
- Updating Public Access and Land Management Plans.
- Sustaining the watershed ranger program.
- Implementing the Watershed Protection Act land use regulations.
- Replacing watershed sanitary surveys with more detailed sub-basin Environmental Quality Assessments.
- Creating wastewater pilot projects.
- Supervising the installation of sewers in the most critically impacted sections of the watershed.
- Developing a community Technical Assistance contract program.
- Sponsoring public education projects.
- Achieving no fecal coliform bacteria counts above the 20 cfu/100 ml limit since January, 1999.

These measures have augmented BWM’s understanding of potential watershed contamination sources, their influence on intake water quality, and the most feasible and effective control approaches.

Another reason for the Plan update is the DCR and MWRA focus on public health and the continued high priority concern of the U.S. Environmental Protection Agency (EPA) and DEP focusing on the threat of *Giardia* and *Cryptosporidium* pathogens. The studies conducted by DWM over the past

five years concerning watershed processes and potential pollution sources, along with the federal and state agencies' ongoing focus on pathogens, have advanced the BWM watershed protection program beyond the frameworks provided by the 1991 and 1998 Plans.

Throughout the early 1990s, MWRA also conducted a series of studies and plans to determine its approach to system treatment. MWRA evaluated both filtration and non-filtration alternatives to comply with the Safe Drinking Water Act (SDWA) regulations. MWRA chose a balanced investment strategy of watershed protection, improved treatment with ozone, a new distribution tunnel and covered storage facilities, and an extensive program to rehabilitate community water pipes. In October 1998, MWRA and MDC/DWM submitted an application for a waiver from the filtration requirement for the Wachusett Reservoir (**see Section 1.4**). As a component of the application for this waiver, MDC/DWM and MWRA were committed to update this Plan on a five-year cycle.

Throughout this past five-year period, the BWM has been refining its strategies to best meet the goals of the Watershed Protection Plan. Several significant management plans have been developed or revised, representing the framework for the agency's approach to water quality protection. This Plan Update unifies the goals and objectives described in the following plans:

- 1998 Land Acquisition Plan (Section 4.1).
- 2001 Wachusett Land Management Plan (Section 4.2.3).
- 2003 Public Access Plan (Section 4.2.1)

The Bureau has also commissioned several studies by expert consultants on a variety of technical topics, including:

- 1999 Stormwater Management, by Camp, Dresser and McKee, Inc. (Section 6.2)
- 1998 Agriculture, by Comprehensive Environmental, Inc. (Section 6.4.2)
- 1998 Highways/Railways Hazardous Material Transportation Release Control Project by Rizzo Associates (Section 6.2 and 6.3.2)
- 1997 Hazardous Materials Emergency Response Plans, by Comprehensive Environmental, Inc. (Section 6.3.2)

The Watershed Protection Plan acts as an “umbrella” for all of the Bureau's activities. This document presents the most critical elements of each management plan and study; the individual plans and studies provide substantially more detail on their particular issues.

Both MWRA and DCR are dedicated to watershed protection as part of a multi-barrier approach to drinking water quality. This Plan Update provides an opportunity to consider the implementation of DWM's programs since 1998, integrate the increased knowledge of water quality and watershed sources of concern, and set a focused watershed protection agenda for the next five years.



## ***1.4 Regulations and Policies Concerning Watershed Protection Plans***

This Plan Update is intended to provide BWM with a focused program of activities for the next five years, reflecting the agency's goals and priorities, and to satisfy DEP and EPA criteria for watershed protection for unfiltered systems. The Plan's content has been organized to address the various regulations and guidelines pertaining to adequate watershed protection (see **Table 1-2**)

The following subsections describe these regulations and policies, their guidelines for watershed protection plans, and how these requirements are reflected in this 2003 Plan Update.

### **1.4.1 Surface Water Treatment Rule (SWTR)**

The federal SWTR regulations were promulgated in June 1989 to reduce the risk of waterborne disease from microbial pathogens.

The SWTR provides two paths for adequate public health protection. It requires filtration for all surface drinking water supplies, unless the water supply is of very high quality and meets specific criteria to qualify for a waiver. One of these criteria is an adequate watershed control program. The rule emphasizes the need for the watershed control program "to minimize the potential contamination by *Giardia* cysts and viruses in the source water," and requires an equivalent level of treatment through disinfection.

The SWTR establishes minimum requirements of the watershed control program as:

- Assessing the hydrology, land cover, and land use characteristics of the watersheds.
- Describing activities or characteristics of the watershed that may impact source water quality adversely.
- Monitoring and controlling these activities or characteristics.

In addition, the SWTR also requires that the public agency responsible for watershed management demonstrates control over the watershed's land, either through land ownership or through agreements with private land owners. There must also be an annual survey by the primacy agency (in this case, DEP) that documents the effectiveness of the watershed control program.

This 2003 Plan Update includes all required elements: Section 2 addresses hydrology and land use, Section 4 describes control of watershed lands, Section 5 addresses monitoring, and Section 6 identifies potentially adverse activities and their controls.

**Table 1-2**  
**Regulations and Policies Concerning Watershed Protection Plans**

<b>Regulatory Agency</b>	<b>Name</b>	<b>Year</b>
EPA, DEP	Surface Water Treatment Rule	1989
EPA	Guidance Manual for Compliance with the Filtration and Disinfection Requirement	1990
DEP	Policy 89-09 – Watershed Resource Protection Plan Policy	1990
DEP	Guidance on the Preparation of a Watershed Resource Protection Plan	1990
DEP	Program to Measure Success of Watershed Protection Efforts Conducted by Public Surface Water Supplies to Obtain, and Maintain, a Waiver from Filtration Requirements (“Measures of Success”)	1996
DEP	“Developing a Local Surface Water Supply Protection Plan”	1996
DEP, EPA	State Source Water Assessment & Protection Program Guidance	1997
EPA, DEP	Interim Enhanced Surface Water Treatment Rule	1998
EPA	Long Term 2 Enhanced Surface Water Treatment Rule (LT2)	2003

Source: DCR/DWSP/BWM and MWRA, 2003.

#### **1.4.2 EPA Guidance Manual for Compliance with the Filtration and Disinfection Requirement**

The SWTR contains few specific requirements for watershed control, beyond the general topics listed above. EPA’s interpretation and application of the SWTR watershed control requirement is described in the *Guidance Manual for Compliance with the Filtration and Disinfection Requirement for Public Water Systems Using Surface Water Sources* (EPA, October 1990).

This manual presents advisory guidelines to primacy agencies. It defines a watershed control program as “a surveillance and monitoring program which is conducted to protect the quality” of a source. Specific elements of a watershed control program are recommended, each of which is addressed in this 2003 Plan Update as shown in **Table 1-3**.

#### **1.4.3 DEP Policy 89-09 and Guidance on the Preparation of a Watershed Resource Protection Plan**

In January 1990, DEP issued Policy 89-09, *Watershed Resource Protection Plan Policy*, which concerns the minimum information to be included in a watershed plan submitted under the SWTR

filtration avoidance procedures. The Policy requires the same six elements identified in the EPA Guidance Manual. In addition, the Policy identifies a series of map overlays to be prepared, and some additional detail concerning the contents of the six elements.

This plan includes all of the required content. All maps were created in ARC/INFO or ArcView format and are compatible with MassGIS and DEP standards. **Table 1-3** summarizes DEP Policy 89-09 along with notations of where each requirement is contained in this Plan Update.

#### **1.4.4 DEP Measures of Success**

DEP has prepared a document titled “Program to Measure Success of Watershed Protection Efforts Conducted by Public Surface Water Suppliers to Obtain, and Maintain, a Waiver from Filtration Requirements, Draft #5” dated April 11, 1996. Referred to as the “Measures of Success,” the document specifies DEP’s process for assessing requests for filtration waivers and criteria – termed programmatic milestones – to measure the success of the water supplier’s watershed efforts.

The “Measures of Success” identifies programmatic milestones organized into the following topics:

- |                                |                                       |
|--------------------------------|---------------------------------------|
| 1. Watershed Control           | 6. Sampling                           |
| 2. Public Access/Recreation    | 7. System Operation/Maintenance       |
| 3. Wildlife Management         | 8. Staffing                           |
| 4. Infrastructure Improvements | 9. Emergency Planning/Response        |
| 5. In-lake Problems            | 10. Education/Multi-town Coordination |

To aid in comparing the Plan Update to the “Measures of Success,” the matrix in Appendix A shows each programmatic milestone, the status of that milestone in the Wachusett Reservoir watershed, and references to relevant sections of this Plan.

#### **1.4.5 DEP’s “Developing a Local Surface Water Supply Protection Plan”**

This document, prepared in July 1996, is intended to provide water suppliers with a low-cost method to develop a plan. The guidance is based on two maps and seven sections. Although this guidance was intended for smaller, less sophisticated water supplies and does not apply to the more advanced BWM program, this Plan Update does contain the identified items.

#### **1.4.6 DEP’s Source Water Assessment Program (SWAP)**

The Federal Safe Drinking Water Act Amendments of 1996 emphasize the importance of protecting public drinking water. The law requires every state to examine existing and potential threats to the quality of all its public water supply sources and to develop a Source Water Assessment Program (SWAP). DEP’s SWAP process has delineated protection areas for all public ground and surface water sources, inventoried land uses in these areas that may present potential threats to water quality,

**Table 1-3**  
**Location of EPA Guidance Manual and DEP Policy 89-09 Requirements in Plan Update**

<b>Item</b>	<b>Plan Update Section</b>
<b>Report Submission</b> <ul style="list-style-type: none"> <li>▪ Narrative</li> <li>▪ Maps</li> </ul>	1 Throughout Plan
<b>A. Watershed Description</b> <ul style="list-style-type: none"> <li>▪ Location of major physical features and system components <ul style="list-style-type: none"> <li>○ Watershed zones A, B, C</li> </ul> </li> <li>▪ Hydrological characteristics</li> </ul>	2
<b>B. Identification of Watershed Characteristics and Activities Detrimental to Water Quality</b> <ul style="list-style-type: none"> <li>▪ Naturally occurring sources <ul style="list-style-type: none"> <li>○ Erosion potential</li> <li>○ Animal populations</li> </ul> </li> <li>▪ Manmade contamination sources <ul style="list-style-type: none"> <li>○ Activities subject to state/federal approval</li> <li>○ Sewered areas</li> <li>○ Gas stations and petroleum storage</li> <li>○ Zoning</li> <li>○ Land use</li> <li>○ Hazardous waste sites</li> </ul> </li> </ul>	2, 3  6.4 6.4.1 4.2.2, 6.4.2 5, 6 5.2.2 6.1.2 5.2 3, 5.2.1 3, 5.2.1 3
<b>C. Risk Assessment and Control of Detrimental Activities/Events</b> <ul style="list-style-type: none"> <li>▪ Summarize results and assess risk</li> <li>▪ Control mechanisms</li> </ul>	2
<b>D. Monitoring</b> <ul style="list-style-type: none"> <li>○ Source water information, Monitoring sites</li> </ul>	5
<b>E. Agreements and Delineation of Land Use/Ownership</b> <ul style="list-style-type: none"> <li>▪ Land ownership</li> <li>▪ Efforts to obtain ownership</li> <li>▪ Efforts to obtain agreements and control</li> <li>▪ Compliance with agreements</li> </ul>	4.2.3 4.1 4.1 4.1
<b>F. Management/Operations</b> <ul style="list-style-type: none"> <li>▪ Management <ul style="list-style-type: none"> <li>○ Organization structure</li> <li>○ Staff requirements</li> <li>○ Staff education, certification, and training</li> <li>○ Annual report</li> </ul> </li> <li>▪ Operations <ul style="list-style-type: none"> <li>○ Ongoing patrol to identify and react to potential impacts</li> <li>○ Emergency response plan; Operational changes</li> </ul> </li> </ul>	9     4.2., 5, 6 6.3.2, 7

Source: DEP, 1990; DCR/DWSP/BWM, 2003

determined the susceptibility of water supplies to contamination from these sources, and publicized the results. Source Water Assessments are intended to help local and state officials target inspections and technical assistance where they are needed the most, encourage cooperative emergency response, and contribute to comprehensive protection of all public water sources.

Information in the SWAP is also required in the MWRA's annual Consumer Confidence Report (CCR). The first SWAP for the Wachusett Reservoir watershed was completed in 2002. DEP noted that the BWM "meet DEP's annual review of 'Measures of Success' for implementation of Watershed Protection Plans and disinfection treatment processes." The SWAP further notes that "MDC [has] implemented DEP-approved Watershed Protection Plans to protect source waters since 1991" (DEP, 2002). Because the SWAP was developed by a uniform, statewide process based on information available for every source, the reports contain much more general information compared to the site specific data in this Watershed Protection Plan or other watershed management documents by either the BWM or MWRA.

#### **1.4.7 EPA Interim Enhanced Surface Water Treatment Rule (IESWTR)**

EPA promulgated the Interim Enhanced Surface Water Treatment Rule (IESWTR) in December, 1998. The IESWTR builds on the SWTR, adding requirements of treatment and control for *Cryptosporidium*. The IESWTR adds the specific requirement that unfiltered water systems must maintain a watershed control program to minimize the potential for *Cryptosporidium* contamination, including identifying and monitoring watershed characteristics and activities that may have an adverse effect on water quality.

The IESWTR includes the following provisions: 1.) A Maximum Contaminant Level (MCL) goal of zero is established for the protozoan genus *Cryptosporidium*; and 2.) Surface water systems that are required to filter under the SWTR must achieve at least 2 log removal of *Cryptosporidium*. In the IESWTR, EPA states, "it appears that unfiltered water systems that comply with the source water requirements of the SWTR have a risk of cryptosporidiosis equivalent to that of a water system with a well-operated filter plant using a water source of average quality."

EPA planned to continue evaluating this issue when additional data becomes available. This Plan Update has been prepared to minimize potential for water contamination from *Cryptosporidium*, as well as *Giardia* and pathogenic bacteria and viruses.

#### **1.4.8 New Federal Drinking Water Regulations**

The 1996 Amendments to the Safe Drinking Water Act called for EPA to issue two new regulations by May 2002: the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) and the Stage 2 Disinfectants/Disinfection By-products Rule (Stage 2 D/DBP). EPA has been developing these rules, for both filtered and unfiltered water supplies, in order to increase protection against microbial pathogens while limiting the by-products of disinfection treatment. The draft rules were published in the summer of 2003; the final rules are expected to be promulgated in spring 2004. The most important impact of these new regulations is the likely requirement by 2012 for 99%

inactivation of *Cryptosporidium* and use of a second primary disinfectant. Disinfection is the responsibility of MWRA as it delivers the source waters from Wachusett and Quabbin Reservoirs to its customers in 47 communities.

### **Long Term 2 Enhanced Surface Water Treatment Rule**

The purpose of the LT2ESWTR (or LT2) is to improve protection of consumers against the protozoan pathogen *Cryptosporidium* originating in the source water. This is directly related to successful watershed protection measures in primarily controlling animal (e.g., beaver and other wildlife) sources. The principal components of LT2 of importance to the DCR and MWRA include:

- Tiered levels of treatment for both filtered and unfiltered water supplies based on the testing of *Cryptosporidium* levels in source waters (eliminating the prior “one size fits all” approach).
- Requiring a minimum 2-log (99%) inactivation of *Cryptosporidium* for unfiltered supplies, with 3-log (99.9%) required if source water testing shows an average of more than 1 *Cryptosporidium* oocyst per 100 liters. Current reservoir samples indicates that the DCR/MWRA system is likely to stay well below the 1/100 liter trigger.
- Unfiltered supplies must use at least two primary disinfectants, with one achieving the 4-log virus inactivation. Primary disinfection is designed to inactivate (kill) pathogens. Residual disinfection is designed to maintain the safety of the water as it passes through the distribution system on its way to consumers. MWRA currently uses chlorine for primary disinfection, and chloramines for residual disinfection. The new Walnut Hill Water Treatment Plant is designed to use ozone as primary disinfectant and chloramines as residual disinfectant when it goes on-line in January 2005.
- Unfiltered supplies must add *Cryptosporidium* control to their watershed protection plans and all current filtration avoidance criteria must continue to be met. The DCR/MWRA system is currently in full compliance with this avoidance criteria.

EPA lengthened the compliance time line to approximately eight years by including the need to conduct two years of source water sampling for *Cryptosporidium* prior to making decisions about the regulations’ level of treatment. Compliance with these regulations, therefore, will not be required until about 2012.

An unexpected factor that arose during the course of the regulatory negotiation process was that ultra-violet (UV) light was found to be a powerful disinfectant against *Cryptosporidium* and *Giardia*. This surprising finding altered the negotiation process as it made inactivation of *Cryptosporidium* much less expensive than previously thought for both filtered and unfiltered systems. MWRA concluded that UV had potential for use at both Wachusett and Quabbin Reservoirs. It was too late in the construction process for immediate inclusion in the Walnut Hill Water Treatment Plant, however it is seen as the most likely disinfection process for the facilities necessary to inactivate *Cryptosporidium* at both Quabbin and Wachusett Reservoirs.

## **Stage 2 Disinfectants/Disinfection By-products Rule**

Disinfectants such as chlorine interact with naturally present organic matter in the source water to form various by-products. The amount of organic matter in the source water is directly related to the ability of watershed protection measures to control contaminant introduction in a reservoir and its tributaries.

Previous disinfection by-products (DBPs) rules focused on certain chlorine by-products, which at high enough doses over many years may cause cancer. These regulations controlled levels as averaged over all sample locations over four quarters. MWRA's DBP levels have always been below the levels considered potentially problematic. Some toxicological and epidemiological studies over the last few years have raised the possibility that these by-products might also cause developmental and reproductive impacts (miscarriages and birth defects), but over a much shorter period (weeks to months). One goal, therefore, of the Stage 2 Disinfectants/Disinfection By-products Rule (Stage 2 D/DBP or Stage 2 Rule) was to reduce the variability (or high points) of the DBP levels within drinking water systems. The principal components of the Stage 2 Rule of importance to the DCR/MWRA water supply system include:

- The average trihalomethane (THM) MCL of 80 parts per billion (ppb) and average haloacetic acid (HAA) MCL of 60 ppb will remain unchanged.
- An important change will be made in the method of measurement for these contaminants. Sampling will have to include those locations most likely to have high levels and each location will be averaged separately. This Locational Running Annual Average has the effect of reducing allowable levels by about a half for systems that use free chlorine for their residual disinfectant. MWRA expects to be able to comply with these requirements based on the use of the slower reacting chloramines for residual disinfection. THM's and HAA's will also be substantially reduced from their current levels when the Walnut Hill Water Treatment Plant goes on-line in January 2005.
- Drinking water systems will need to re-examine their THM and HAA sampling locations and many will need to conduct a short-term, extensive sampling program to identify locations where DBPs are higher to determine where the compliance samples should be taken. There will also be a variety of complex transitional issues laid out in the rule, primarily to allow EPA to keep the compliance schedules of the two rules in-sync, but also to move systems from the current rule to the new, without having any increase in risk.
- The average bromate (a by-product of ozonation) MCL of 10 ppb will remain unchanged. Initial tests conducted for bromate indicate that the new treatment plant will be in compliance with the 10-ppb standard when it goes on-line in January 2005.

The process and timetable for Stage 2 Rule promulgation are the same as the LT2. Compliance is also expected by the year 2012. Watershed protection and the designed operation of the DCR/MWRA reservoir system can control the amount of organic material in the source water and reduce the potential for DBP formation.

## ***1.5 Filtration Waiver***

The MWRA Board of Directors voted in October, 1998, to build a new water treatment facility using ozonation with chloramination for disinfection and other treatment objectives for the water from Wachusett Reservoir. MWRA's treatment technology decision was the culmination of a ten year process of study and research on the needs of the water supply system, current information on water treatment effectiveness on pathogens of concern, disinfection byproducts, watershed protection and public health concerns, with input from the public and water supply and public health experts. The Authority's conclusion was that an ozonation/chloramination plant would provide appropriate treatment of the water supply from Wachusett Reservoir, and that adding filtration to the new plant for \$180 million would not provide as much additional benefit as would using funds to rehabilitate old unlined cast iron pipes in the MWRA and local distribution systems. As part of the treatment technology decision, MWRA expanded a program of public health surveillance and financial incentives for communities to target rehabilitation of community pipes, and proposed a full review of the need for further treatment including filtration by December 2003.

This plan was presented to the Massachusetts Department of Environmental Protection (DEP) under the provisions of the June 1993 administrative consent order between DEP, MWRA and MDC. That consent order allowed MWRA and MDC to pursue a "dual track" for regulatory compliance with the Surface Water Treatment Rule (SWTR) of the Safe Drinking Water Act (SDWA) for the Wachusett Reservoir. It required MWRA to design a filtration plant and to build it, unless MWRA could demonstrate with MDC that the system met the criteria for avoiding filtration and DEP determined that filtration was not required.

DEP agreed with MWRA's approach in December 1998 after a hearing and comment period, and determined that filtration was not required for the DCR/MWRA system. EPA, however, did not agree and continued to prosecute the enforcement action previously filed under its SDWA "overfiling" rights, seeking to require MWRA to build a filtration plant, contending that the SDWA allowed no other option.

In December 1998, the EPA moved for partial summary judgment claiming as a matter of law that MWRA was in violation of the SWTR and that the Court was required to order filtration.

In May 1999, U.S. District Judge Richard Stearns granted the United States' motion in part, ruling that MWRA was not in compliance with the filtration waiver criteria as a result of its having detected fecal coliform bacteria levels in the reservoir above permissible levels on 14 days (in December 1998 and January 1999) out of 130 days tested for the six month period. The SDWA criteria permit exceedances on only 13 days in a six month period (10% of the samples). However, the Court ruled that it had discretion to order a remedy other than filtration and set the question of remedy for trial beginning in October. Judge Stearns reasoned that judicial discretion was necessary since technology evolves more rapidly than legislation and "an overly rigid application of the filtration mandate by the EPA might result in a wasteful expenditure of finite public funds to correct de minimis problems." (Kurtz, 2000)

The trial date was postponed when the United States sought to appeal the ruling, claiming that whether or not the Court has discretion to order a remedy other than filtration was a controlling



question of law that should be decided prior to any trial. The U.S. Court of Appeals for the First Circuit denied the Government's request for appeal, and the trial began in December.

After two months of testimony, the U.S. District Court ultimately concluded that the comprehensive strategy to improve drinking water proposed by MWRA and MDC/DWM, through watershed protection for Wachusett and Quabbin reservoirs, a new ozonation/chloramination disinfection facility, and a community pipe rehabilitation program, sufficiently protects the public health and cost-effectively improves drinking water quality. (Kurtz, 2000; *U. S. v. MWRA*, 97 F.Supp.2d 155)

An appeal was made by the EPA to the US Court of Appeals, arguing that the District Court did not have the discretion to rule on any injunction other than building a filtration plant if there was a violation of the SWTR. The Appeals Court again ruled in favor of the MWRA.

The Appeals Court noted that it was not faced with an imminent threat to public health as none had been alleged by the United States. After discussing the language and intent of the SDWA, and comparing it to other regulatory enforcement schemes, the Court found that the statute did not create a "necessary and inescapable inference" as to the necessity of filtration upon a finding of a regulatory violation. The Court also found that the goal of the SDWA was safe drinking water, and that although filtration served an important role, it is merely a prophylactic remedy: "the manifest purpose of the SDWA is safe drinking water, not filtration."

In affirming the district court's exercise of discretion, the Court noted that "the district court did not hold a trial to revisit the underlying wisdom of the SWTR; rather, it held a trial to ascertain whether, based on both the particular facts of this case and the substantive goals of the Act, it was more appropriate to order filtration or to permit the MWRA to pursue its alternative approach to the extent that it could satisfy the Rule's avoidance criteria and ultimately provide a safer water supply." The Court noted that "it should be a rare case in which violation of regulatory standards does not lead to an injunction" but it agreed with the district court that this was indeed such a rare case. It found that the district court had carefully shaped its decision to ensure continued compliance with the avoidance-criteria standards, and retained jurisdiction "for the purpose of policing any future violation." Thus, "the district court used its equitable discretion to appropriate ends: furthering the substantive purposes of the Act." (Kurtz, 2001; *U. S. v. MWRA*, 97 F.Supp.2d 155)

The EPA did not appeal this decision to the U.S. Supreme Court. Therefore, the District Court "assumed the responsibility of monitoring MWRA's compliance in the event that future violations require re-examination of the decision not to order filtration." (*U. S. v. MWRA*, 256 F.3d 36)

## 1.6 Scope of 2003 Plan Update

The DCR has been aggressively implementing and expanding its watershed programs since the initial Watershed Protection Plan was published in 1991. The U.S. District Court recognized this progress, when it stated:

The story of Wachusett water quality in the last decade has been one of continuing improvement, in some respects gradual, in others dramatic... The milestones in this progress [are]... (a) the passage by the Legislature of the 1992 Watershed Protection Act; (b) the strong public support generated by conservation groups for the MDC's largely successful efforts (to date) to preserve and protect the Wachusett watershed; (c) the full implementation of the gull harassment program;... and (h) the sewerage of septic systems in the Towns of West Boylston and Holden. (*U. S. v. MWRA*, 97 F.Supp.2d 155)

The 2003 Wachusett Reservoir Watershed Protection Plan Update continues this trend of identifying key issues and setting priorities for the DCR Bureau of Watershed Management. This Plan Update:

- Documents the recommendations of the 1998 Plan that have been completed.
- Incorporates increased knowledge of the watershed and water quality.
- Assesses the current "state of the watershed."
- Formally states goals and five-year objectives for each program area.
- Establishes a schedule of activities for the next five years.

The BWM's 2000 *Watershed Protection Plan Update for the Quabbin Reservoir Watershed and Ware River Watershed* is unchanged by this document.

